Sheet 1. 3 Sheets.

W. H. McNary.

Knitting Mach.

No. 64,241 Patented Apr. 30, 1867.

Fig. 2.

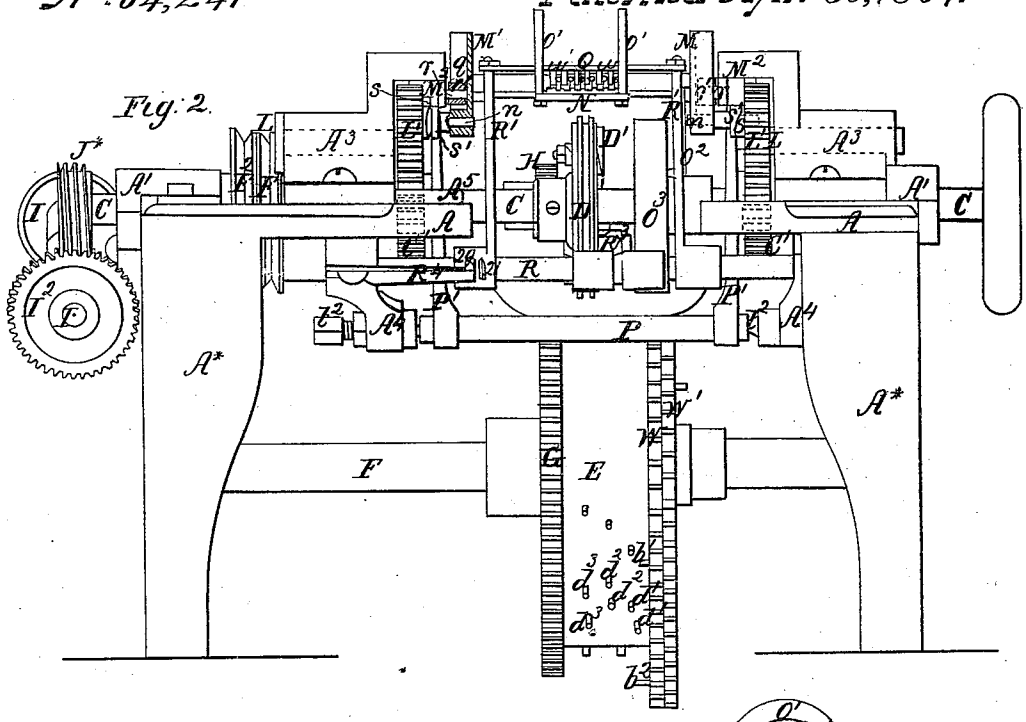
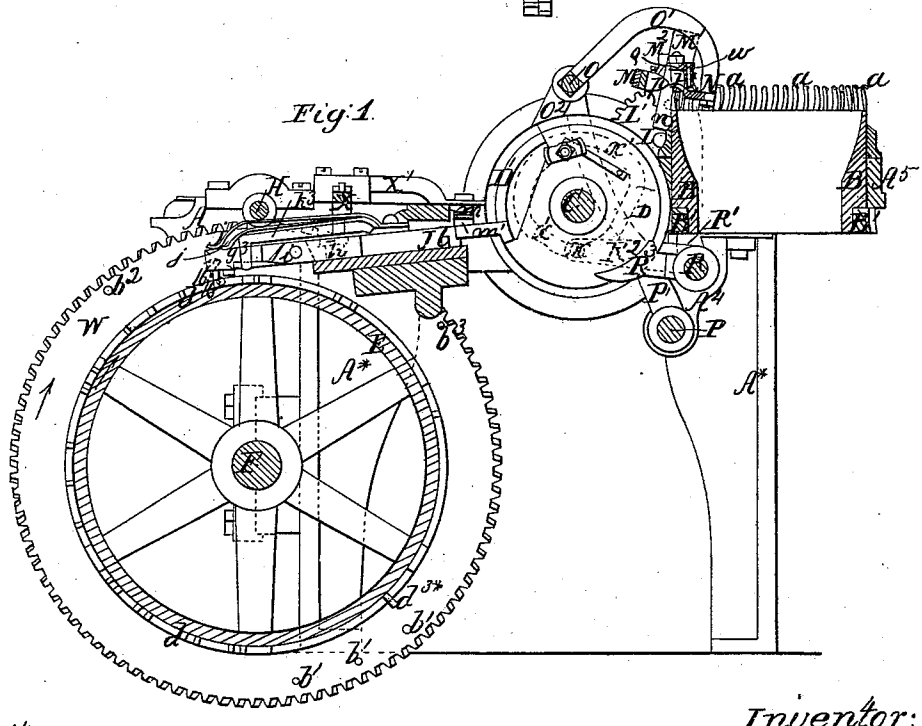


Fig. 1.



Witnesses;
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W. H. McNary
per Munn & Co
Attorneys

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Fig. 9.

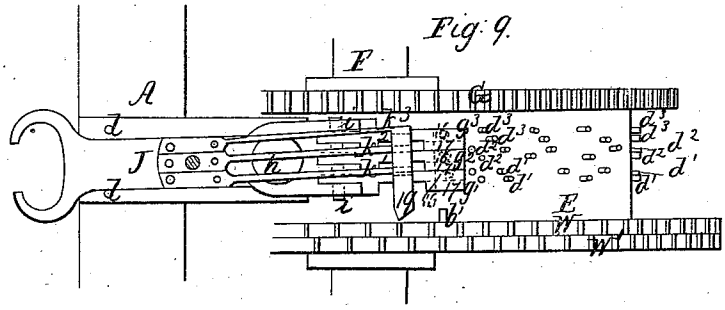

Fig. 3.

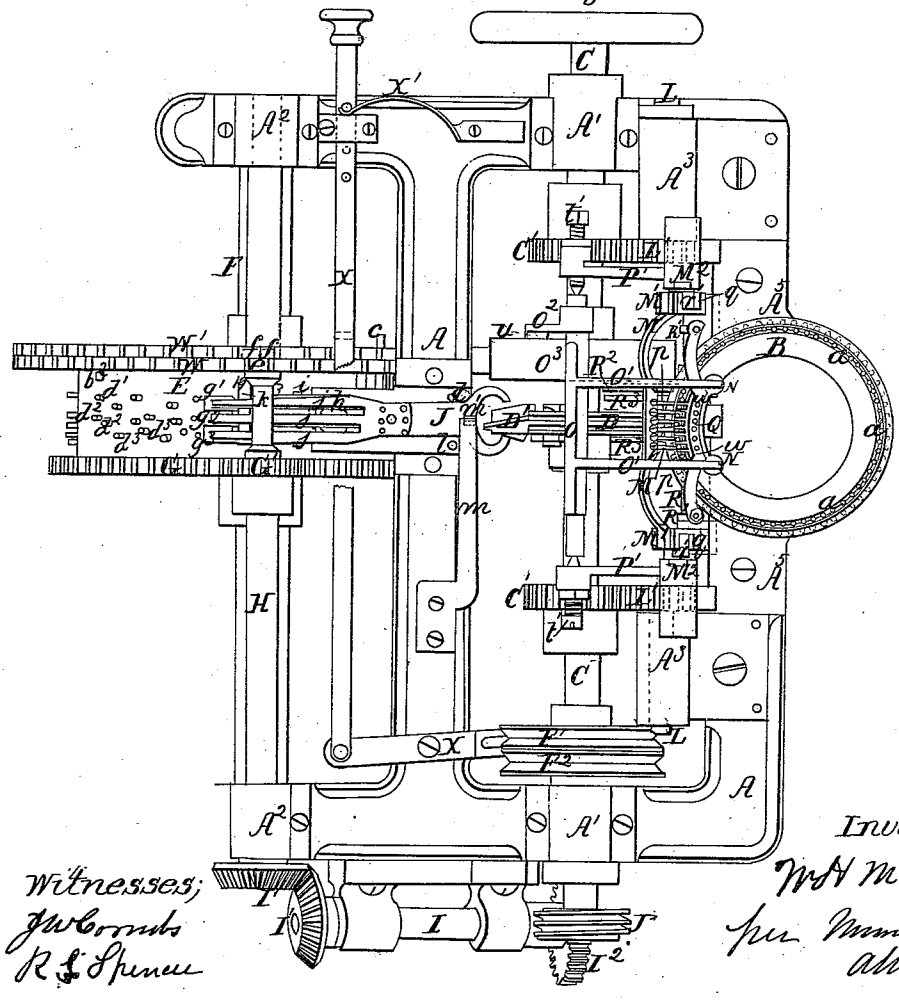

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Fig: 4.

Fig: 14.

Fig: 5

Fig: 13.

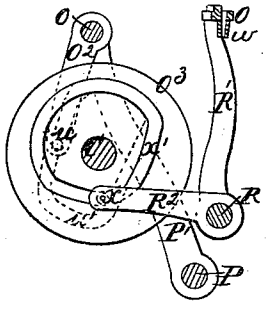


Fig: 15

Fig: 6.

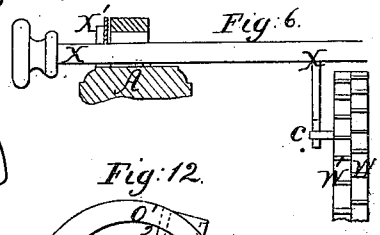


Fig: 12.

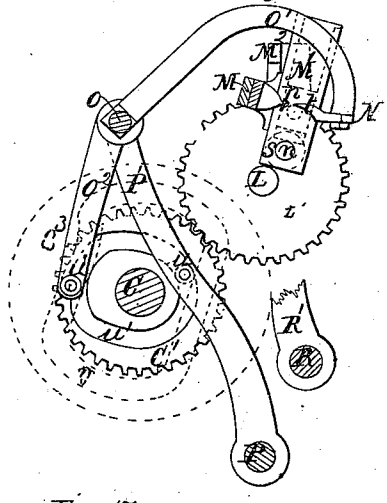


Fig: 7.

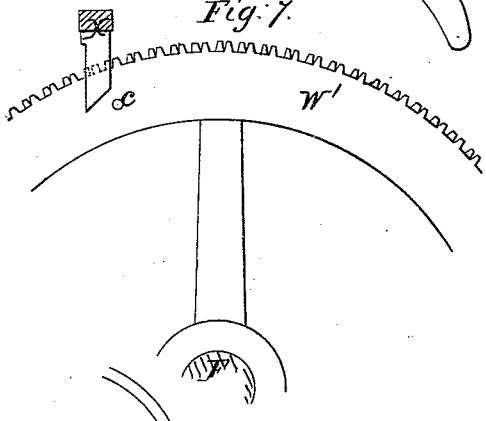


Fig: 17

Fig: 16.

Fig: 8.

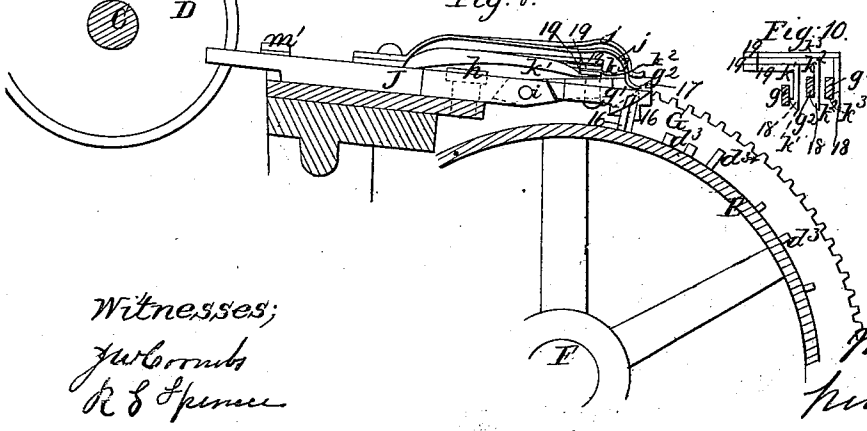
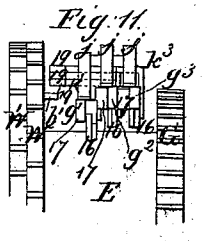


Fig: 10.

Fig: 11.



Witnesses;
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R S Spencer

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United States Patent Office.

WILLIAM H. McNARY, OF BROOKLYN, NEW YORK.

Letters Patent No. 64,241, *dated April* 30, 1867.

IMPROVEMENT IN KNITTING MACHINES.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, WILLIAM H. McNARY, of the city of Brooklyn, in the county of Kings, and State of New York, have invented certain new and useful improvements in Knitting Machinery; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical section of a machine with my improvements, taken at right angles to its principal shaft.

Figure 2 is a front view of the same, with the needle-ring and its holder omitted to expose the parts in rear thereof.

Figure 3 is a plan of the same.

Figures 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13, are views, which will be hereinafter explained, of some of the parts of the machine.

Figures 14 and 15 illustrate the manner in which the machine knits a number of stockings in a continuous piece.

Figures 16 and 17 illustrate a peculiar effect in knitting produced by one feature of my invention.

Similar letters of reference indicate corresponding parts in the several figures.

The several improvements which constitute this invention relate to that class of knitting machines employing needles with short, inflexible hooks, from which the stitches are taken by stitch-hooks without any longitudinal movement of the needles themselves. The said improvements are for the most part more especially applicable to such machines of that class as have the rotary or lateral motion of their needles controlled, for the purpose of giving the desired form to stockings or other articles, by means of a rotary studded cylinder or drum, and a threaded wheel, as described in my Letters Patent No. 28,290, dated May 15, 1860.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A A* A* is the framing of the machine, consisting of a horizontal plate, A, supported on standards A* A*; B is the needle-ring, in which the needles *a a* are secured. This ring is fitted to rotate in a circular opening in a plate, A^5, bolted to the front part of the plate A, and is held in its place by an externally-toothed ring B′ that is bolted or otherwise firmly secured to its bottom part, as shown in fig. 2; C is the main shaft, arranged horizontally behind and very near the needle-ring, in suitable bearings A^1 A^1; and D is the threaded wheel, which I now term the "switch-wheel," fitted with the movable switch D′, and otherwise constructed and operating as described in my before-mentioned Letters Patent. This wheel is secured upon the main shaft C, and its threads gear directly with the toothed ring B′, which is secured to the needle-ring B, and by this direct gearing the said wheel is made to drive the needle-ring without the intermediate gearing described in my before-mentioned Letters Patent. E is the studded cylinder by which the switch D′ of the switch-wheel D is operated upon to control the direction and changes of direction of the revolution of the needle-ring, said cylinder being fast upon a horizontal shaft, F, arranged parallel with the main shaft. The said cylinder has firmly secured to or cast with it a spur-wheel or ring of spur teeth G, which gears with a spur-wheel, G′, of smaller size, on a shaft, H, which is arranged in bearings A^2 A^2 on the top of the plate A. The shaft H is also furnished with a bevel-gear, H′, which gears with a bevel-gear, I^1, on a shaft, I, arranged in bearings at one side of the machine, and the latter shaft carries a worm-gear, I^2, which gears with an endless screw, J*, on the main shaft C, and through the shafts I and H, and their gearing. The shaft F and cylinder E are caused to derive a slow but uninterrupted rotary motion from the main shaft. This cylinder E is of larger diameter, and shorter, than that described in my before-mentioned Letters Patent, and has on its periphery three double rows of studs, d^1 d^1 d^2 d^2 and d^3 d^3, arranged in lines running directly round it. W W′ are two spur-wheels secured firmly and closely together side by side, and fitted to turn freely upon the shaft F, close to the studded cylinder E, and on the opposite side thereof to the wheel or gearing G, but not allowed to move longitudinally upon the said shaft. The wheel W carries on the face next the cylinder E a series of pins, b^1 b^1 b^2 b^3, whose duty is to operate upon certain adjuncts of the forked lever through which the studs *d d* shift the switch D′, as will be presently explained, and the wheel W′ carries on the face furthest from the cylinder E a pin, *e*, which operates upon the belt-shipper X to unlock it and leave it under the control of the spring X′, which gives it the necessary movement to shift the

driving-belt from the fast pulley F^1 to the loose pulley F^2 of the driving-shaft, for the purpose of stopping the machine. Fig. 6 is a back view of the shipper, and fig. 7 a side view of the same partly in section, on a larger scale than figs. 1, 2, 3. The cylinder E makes several revolutions during the knitting of a stocking, but the wheels W W′ make exactly one revolution during that operation, their movement being produced by a single tooth, *e*, (see figs. 3 and 4,) on the shaft H, such tooth gearing with the wheel W, and moving the said wheel one tooth during each revolution of the shaft H. The wheel W′ is for locking the wheel W while the tooth *e* is out of gear, its teeth being so arranged relatively to those of W that when the tooth *e* escapes from a tooth of the latter, a cylindrical portion, *f*, of the shaft H, fits between two of the teeth of W′ in such a manner (shown in fig. 5) as to prevent the wheels moving in either direction. The unlocking of the wheels every time the tooth *e* comes into operation on a tooth of the wheel W is effected by a notch, *f′*, in the cylindrical portion *f* of the shaft H, coming at the same time into position to receive a tooth of the wheel W′. J, (figs. 1, 3, 8, and 9,) is the forked lever, which I now term the "switch-lever," through which the studs d^1 d^1 d^2 d^2 d^3 d^3 of the cylinder E are made to operate upon the switch D′ of the switch-wheel D. Fig. 8 exhibits a side view of this lever and the switch-wheel, and a section of the cylinder E, on a larger scale than figs. 1 and 2; and fig. 9 is a plan view corresponding with fig. 8. This lever works horizontally on a fixed fulcrum, *h*, but instead of being made in one piece and perfectly rigid, like the corresponding lever described in Letters Patent No. 28,290, is furnished at its rear end, which is situated above the cylinder E, with three fingers, g^1 g^2 g^3, attached by a hinge or pin-joint, *i*, which permits them to move upward and downward relatively to the principal portion of the lever, but does not allow them to move horizontally independently of the lever. The said joint is further so constructed that the said fingers g^1 g^2 g^3 are not quite permitted to touch the body of the cylinder, but that a triangular downward projection, 16, on the rear part of each one, is allowed to come so near to the body of the cylinder as to be subject to be acted upon by its respective double row of studs d^1 d^1 d^2 d^2 or d^3 d^3, to produce the horizontal movement of the lever. A three-pronged-spring, *j*, secured to the rigid portion of the lever, presses separately upon each of the fingers g^1 g^2 g^3 in such manner as to tend always to hold down the latter as far as the construction of the joint *i* permits, but this spring allows either finger to be raised up high enough for its respective studs d^1 d^1 d^2 d^2 or d^3 d^3 to pass without touching its projection 16, whenever a wedge-like portion, 17, of such finger is operated upon by one of three larger studs d^{1*} d^{2*} d^{3*}, which project from the periphery of the cylinder. There is attached to the rigid portion of the lever a three-tongued spring, k^1 k^2 k^3, whose tongues, one for each of the fingers g^1 g^2 g^3, are each so formed with a projection, 18, on one side, as shown in fig. 10, which exhibits an end view of the said spring, and in fig. 11, which is a front view of the said spring, the lever J, and their appendages, that when either of the fingers g^1 g^2 g^3 is raised up by its respective stud d^1 d^2 or d^3, the said projection 18, or its respective tongue of the spring, will pass under the said fingers and hold it up, as illustrated by the tongues k^2 k^3, and fingers g^2 g^3, in figs. 10 and 11. Each of the tongues k^1 k^2 k^3 has on the side next the wheel W a projection, 19, with a wedge-shaped end, to be acted upon by one of the before-described pins b^1 b^1 b^1 b^2 or b^3 on the face of the said wheel, for the purpose of pushing the tongue aside whenever it is desired to liberate and let drop its respective finger g^1 g^2 or g^3. The studs d^1 d^1 operate in connection with the finger g^1 to move the switch-lever during the knitting of the calf of the stocking; those, d^2 d^2, operate in connection with the finger g^2 during the knitting of the heel; and those, d^3 d^3, operate in connection with the finger g^3 in the knitting of the toe. The pins b^1 b^1 b^1 b^2 b^3 throw their respective fingers into operation at the proper stages for commencing the calf, heel, and toe. Three pins b^1 b^1 b^1 are used, as it is desirable to suspend and resume the operation of the switch-lever, and switch twice or more times during the formation of the calf. The longer studs d^{1*} d^{2*} and d^{3*} come into operation on the fingers g^1 g^2 g^3 at the proper stages for suspending the operation of the switch-lever, and continuing to knit all round the whole series of needles, the said studs raising up the said fingers so high that the switch-lever will remain undisturbed by the shorter studs d^1 d^1, d^2 d^2, and d^3 d^3, and while the said lever remains undisturbed the switch D′ will remain stationary relatively to its wheel D, and consequently the needle-ring will derive a continuous rotary motion in one direction from the switch-wheel. *l l* (figs. 1, 3, and 9) are two fixed stops which limit the movement of the switch-lever; and *m* is a locking spring secured to the plate A, and acting upon a bevelled tooth, *m′*, on the top of the lever J, to secure it against either stop, but yielding to the action of the pins d^1 d^2 d^3. It has already been described how the switch-wheel gears directly with the teeth upon the needle-ring, and so drives it without intermediate gearing. In order to enable the main shaft C to be brought to a proper position relatively to the needle-ring to effect this result, the cranks *n n*, which operate the stitch-hooks, are carried, not by the main shaft C, as described in my before-mentioned Letters Patent, but by two short shafts L L, (see figs. 1, 2, and 3, and also fig. 12, which is a sectional side view of the switch-hook operating and presser-operating apparatus,) said shafts being arranged in line with each other, parallel with the main shaft, in bearings in two short standards A^3 A^3 secured on the top of the plate A. These shafts L L are each furnished with a spur gear, L′, which gears with one of two spur gears C′ of similar size, carried by the main shaft. This gearing is best shown in fig. 12. The switch-hook operating apparatus does not differ essentially in its construction and operation from that described in my before-mentioned Letters Patent in any respect, but in having the driving-cranks *n n*, carried by the two separate shafts L L, geared with the main shaft, and hence does not here need any particular description further than is necessary to prevent confusion of the parts of the drawing. *p p* are the stitch-hooks, and M the bar termed the stitch-hook bar, to which they are attached, the said bar being constructed and furnished at its ends with arms M^1 M^1 containing bearings to receive the cranks *n n*, and each arm being slotted or grooved longitudinally, as shown at *q*, in figs. 2 and 3, to receive and slide upon one of the square blocks *r′*, which is fitted to one of two fixed pins *r*, which are held by the two rigid arms M^2 M^2 that are firmly secured to the two standards A^3 A^3. *s s* are the face cams, with which the cranks *n n* are surrounded, for the purpose of giving the necessary longitudinal movement to the stitch-hook bar: and *s′ s′* are the cam-like surfaces provided upon the arms M^2 M^2 for the said cams *s s* to act upon for the above purpose. *t t* are the

pressers attached to a bar, N, carried by the two bent arms O^1 O^1 of a rock-shaft O, which is arranged between centre screws t^1 t^1, carried by the two arms P′ P′ of another rock-shaft P, which is arranged between centre screws t^2 t^2, inserted through the rigid hangers A^4 A^4, dependent from the bed-plate A of the machine. The rock-shaft O has a third arm, O^2, carrying a friction-roller, *u*, which enters a groove, *u′*, in the side of a cam, O^3, on the main shaft. This cam O^3, though not shown in fig. 12, has the form of its groove represented in that figure in red outline. The arms P′ P′ of the rock-shaft P carry friction-rollers *v*, one each, which are received in cam-grooves *v′* in the faces of the two spur gears C C, both cam-grooves *v′* being of the same shape. The form and relation of the cam-grooves *u′* and *v′* is shown best in fig. 12, but the several parts of the presser-operating mechanism are shown with more or less distinctness in figs. 1, 2, and 3, and partly in fig. 13, which exhibits a side view of the cam O^3, with a section of the yarn-conductor and its appendages, and of part of the presser-operating mechanism. The said cam-grooves *u′* and *v′*, by their combined action on the arms O^2 and P′ P′, cause the pressers to receive the following movement, to wit: They first descend to press the work down on the needles, then rise far enough to ease the work up while the stitches are being thrown over the hooks of the needles, then descend again to bring the whole of the work down, and are afterward withdrawn by a movement in a nearly horizontal direction, preparatory to or during their ascent, to bring them to a position to commence the next movement to press the work down again as at first mentioned. By this peculiar movement of the pressers, more especially that part of it which consists in withdrawing them horizontally or nearly so from between the needles, the knitting on immediately adjacent needles is permitted, as the pressers are so kept out of the way of the stitch-hooks and of the yarn-conductors *w w*, that all are permitted to operate in connection with immediately adjacent needles at the same time. The yarn-conductors *w w* are attached to a bar, Q, which is carried by the two arms R^1 R^1 of a rock-shaft, R, which is fitted to rock and also to slide longitudinally in bearings in the hangers A^4 A^4 before mentioned. This rock-shaft R has another arm, R^2, carrying a friction-roller, *x*, which is received in a groove, *x′*, in the cam O^3, and the said cam-groove, by its operation on the said pin, produces the necessary movement of the yarn-conductors to place the yarns in a proper position to be received within the hook of the needles. The lateral movement, termed shifting, which the yarn-conductors require to have every time the direction of the movement of the needle-ring is changed, is produced by the operation of the switch D′, in a fork, R^3, formed upon or rigidly attached to the rock-shaft R, said switch thus giving the said rock-shaft a longitudinal movement in one direction or the other every time the said switch itself is shifted by the lever J. The yarn-conductors have in the knitting operation the usual backward and forward movement between the needles, passing from the inside to the outside of the circle of needles before, and from the outside to the inside thereof, after the lateral movement of the needles, and so causing the yarn to be laid round the outer sides of the needles on which the hooks are situated. It has been customary, when the direction of the rotary or lateral movement of the needle was about to be reversed, to shift the conductors while they were behind or inside of the circle of needles, but I so apply the shaft R and its fork R^3 relatively to the switch-wheel and switch, that the shifting is effected while they are on the outside of the circle or in front of the needles, by which means, on the reversal of the lateral movement of the needles, I cause the first loop, in the new course produced by each of the several yarns employed, to be placed round the same needle as the last loops in the previous course, the effect of which is to produce much stronger, and firmer, and more even work in the heel, toe, and calf, as I will attempt to explain with reference to the diagrams, figs. 16 and 17. Fig. 16 illustrates the effects produced by shifting the conductors inside or behind the needles. The course of loops represented on the needles *a a a′* has been produced while the needles moved in the direction of the arrow and the needles have just made one movement in the opposite direction. It will be seen that the portion of the yarn to form the first loop *y* of the new course passes behind and not round the needle *a′*, upon which the last loop *z* of the former course was formed, and hence when a loop of another course comes to be formed upon the needle *a′*, (as shown in red outline,) it only passes through the loop *z*, and not through the loop *y*. Fig. 17 shows the effect of shifting outside of the needles, viz, carrying the new loop *y* round the last needle *a′*, as well as the next one *a*, and causing the next loop taken on the needle *a′*, (as shown by the red outline,) to pass through both loops *y* and *z*. R^4 is a toothed stop spring, entering one of two notches 20, 21, in the shaft R, for locking it in either position to which it may be shifted by the switch.

I have now described the construction and the individual operations of the several parts of the machine, and before describing the operation of knitting stockings in a continuous piece, as illustrated in fig. 14, I will explain the system by which I produce fulness in the calf. The knitting of each stocking is commenced at the toe, and after the leg has been completed the knitting is proceeded with on one-half of the circular series of needles to form a bag for the toe of the next one, as shown in fig. 15, where B* represents the bag; the line 1, 5, 3, represents half the upper edge of the leg, which has been allowed to remain on the needles while the toe B* has been knitted; the line 1, 4, 3, represents the half of the toe which remains on the needles; and the line 1, 2, 3, represents the line of junction between the leg of the one stocking and the toe of the next, the said line 1, 2, 3, containing the same number of loops as there are in the half 1, 5, 3, of the margin of the leg. The machine is now stopped to remove the loops in 1, 5, 3, from the needles, and place the loops in 1, 2, 3, on the same needles, and the machine again started, when the knitting of the stocking proceeds to completion, and the operation is further continued till a bag, B*, for another one is produced, when the loops in the part 1, 5, 3, require to be exchanged for those in the part 1, 2, 3, as before; this one stoppage in each stocking being the only stoppage necessary in the production of a continuous piece containing any number of stockings, which may be separated by cutting the attached portion of the leg of each close to its junction with the toe of the next one. The fulness in the calf is produced by causing the needle-ring or circular series of needles, instead of having a continuous rotary motion in one direction during the knitting of the whole of the leg of the stocking, to have, at the proper stages of the knitting, a movement in opposite directions, alternately, to the extent of more or

less than a complete revolution, giving it a continuous rotary motion in knitting all the rest of the leg. As I desire to patent this mode of producing the fulness as a separate invention, I have now only described it sufficiently to enable me to explain the operation of the machine. At the starting of the machine the knitting may be commenced in any part of a stocking, according to the relative positions of the studded cylinder E and wheels W W′ with respect to the switch-lever. The most convenient place for commencing will be near the top of the leg, after the pins b^1 b^1 b^1 have all passed fingers g^1 g^2 g^3, the switch-lever and the said fingers g^1 g^2 g^3 have all been raised up out of range of the pins d^1 d^2 d^3 by the action of the pins d^{1*} d^{2*} d^{3*}. The operation will then proceed with a continuous rotary motion of the needle-ring until the toe pin b^3 in the wheel W comes into operation on the projection 19 of the spring k^3, and causes the finger g^3 to be dropped within range of the pins d^1 d^1, which then, by their action on the switch-lever, shift the switch to reverse the needle-ring at proper intervals until the toe of the new stocking has been completed, when the pin d^{3*}, of the cylinder E, comes round and lifts the finger g^3, and the continuous rotary motion of the needle-ring is proceeded with long enough to knit the foot. The heel-pin b^2, on the wheel W, then comes into operation on the spring k^2, and causes the finger g^2 to be dropped within range of the pins d^2, which then by their action on the switch-lever shift the switch at proper intervals to reverse the motion of the needle-ring till the heel is knitted, when the pin d^{2*}, on the cylinder, comes into operation on the finger g^2 and lifts it out of range of the pins d^2 d^2. The operation of knitting the lower part of the leg now proceeds without any reversal of the needle-ring till the first calf-pin b^1 comes round, and by its action on spring k^1 liberates and lets drop the finger g^1 within the range of the pins d^1 d^1, which then operate on the switch-lever to reverse the revolution of the needle-ring as often as may be necessary. During the formation of the calf the finger g^1 is raised by the stud d^{1*}, of the cylinder E, and caused to drop again by the pins b^1 b^1 twice after its being caused to drop by the first pin b^1, the studded cylinder E making three revolutions while the calf is being formed. The fingers g^2 g^3 might in a similar manner be raised and let fall again while the heel and toe respectively are being formed, according as the velocity of rotation of the cylinder E may be proportioned to that of the wheels W W′, which only make one revolution while the stocking is made. It will be obvious to persons familiar with the operations of knitting machinery, that by a proper arrangement of the studs on the cylinder E, the knitting of a stocking may be commenced at the top of the leg, and completed at the toe, but in that case it would be difficult, if possible, to make the toe without its requiring a seam to complete it. Instead of the large wheel W, a small wheel furnished with suitable wipers, and arranged with its axis at right angles to the axis of the cylinder, and having imparted to it an exceedingly slow rotary motion, may be used as an equivalent of such wheel. A switch-lever furnished with one finger, constructed and applied in all respects like g^1 g^2 or g^3, and having springs applied in connection with the said finger, in all respects like j and k^1 k^2 or k^3, may be used in connection with the rotating and longitudinally moving studded cylinder described in my before-mentioned Letters Patent. In the use of one movable finger only, the spring which holds up the finger like k^1 k^2 or k^3 may be tripped by long studs on the cylinder itself.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In combination with the needle-ring the presser having the compound motions, substantially as and for the purpose described.

2. Operating the stitch-hooks by cranks upon separate shafts carrying gear-wheels engaging corresponding wheels on the main shaft, substantially as and for the purpose described; and

3. Connecting the threads of the switch-wheel directly with the needle-ring, substantially as and for the purpose set forth.

WM. H. McNARY.

Witnesses:

HENRY T. BROWN,

WM. H. NEWTON.